MEPPEL
BAD HESSELINGEN

Official test AFM/APF/ACO….and Active carbon

Results after 16 months

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MEPPEL
BAD HESSELINGEN

- Competition pool, 25x15m (850 m^3)
- 5500 visitors/week
- 1 filter Ø 2700, 2 pumps with variable speed controller
- FS: 23 m/h / BS: 45 m/h

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cmark
consultants

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TECHNOLOGY
SUSTAINABLE WATER QUALITY

Van Remmen
UV Techniek

Protocol:

- **STAGE 0** : old situation (sand filtration) — **2 months**
- **STAGE 1** : AFM + APF — **15 months**
- **STAGE 2** : UV (Low pressure) — **4 months**
- **STAGE 3** : Active Carbon (on top of AFM bed) — **2 months**

All tests 1x per month by Eurofins/C-Mark
Always on the same day of the week
Always at the same time

Tested parameters:

- Turbidity, pH, Free Chlorine, Total Chlorine, Combined Chlorine, KMnO4, Urea, Aeroob, Temperature
- Pseudomonas aeruginosa, intestinale enterococcen, clostridia, Staphylococcus, Legionella, Bromate, Chlorate, THM's, Chloride, Nitrate, Trichloramine in air
- Aluminium, Calcium, Magnesia, Kalium, Barium, Carbonate, DOC, AOX

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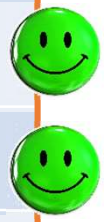
Results

Parameters (according to law)	STAGE 0		STAGE 1				STAGE 2			STAGE 3	
Date	**12-03**	**07-04**	**19-05**	**14-07**	**08-09**	**03-11**	**29-12**	**23-02**	**24-04**	**12-07**	**09-08**
Visibility	bottom	bottom	bottom	bottom	bottom	bottom	bottom	bottom	bottom	bottom	Bottom
pH	7,1	7,3	7,2	7,3	7,4	7,3	7,5	7,4	7,3	7,2	7,4
Free Chlorine (mg/L)	0,7	0,9	1,0	1,0	0,8	1,0	1,1	1,2	1,0	0,9	0,8
Total Chlorine (mg/L)	1,4	1,4	2,0	1,4	1,2	1,4	1,4	1,5	1,3	1,0	0,9
Combined Chlorine (mg/L)	**0,7**	**0,5**	**1,0**	**0,4**	**0,4**	**0,4**	**0,3**	**0,3**	**0,3**	**0,1**	**0,1**
KMnO4-usage (mg/L)	8,3	12,0	16,0	6,2	4,9	6,3	5,4	6,4	4,2	4,1	4,8
Urea (mg/L)	0,5	0,5	0,8	0,8	0,8	0,8	0,6	0,8	0,6	0,5	0,5
Aeroob colony forming 36^{0}C (kve/mL)	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 4	< 1	< 1	< 1
Temperature (^{0}C)	27,4	27,9	28,2	28,2	28,6	28,4	28,2	28,5	28,3	28,3	28,3
	SAND		**AFM/APF**				**+UV**			**+ CARBON**	



Results

Parameters (additional)	STAGE 0		STAGE 1				STAGE 2			STAGE 3	
Date	12-03	07-04	19-05	14-07	08-09	03-11	29-12	23-02	24-04	12-07	09-08
Turbidity	0,5	0,5	0,5	0,11	0,16	0,12	0,27	0,15	0,09	0,20	0,21
Sum THM's	46	56	61	33	24	27	45	43	-	30	25
Trichloramine (air)		495	515	226		192	174	230		165	261
Fresh water per bather	45	46	23	23	15	12	18	12	15	19	28
	SAND		**AFM/APF**				**+UV**			**+ CARBON**	

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RESULTS after 15 months:

- ***Crystal clear*** (turbidity <0,2)
- Even after very high bather load – the water ***stays in perfect condition***
- ***No smell***
- ***Combined chlorine very low*** and steady
- ***THM's decreased*** (60 µg/L → 25 µg/L)
- ***Trichloramines in the air decreased*** (500 µg/m^3 → < 200)

And……

- Better water quality with **only 15L fresh water/visitor** (was 45 L)
- This means they are **saving on water (about 40K / year), heating, chemicals and electricity (about 2000 kW/h / month)**
- The managing director of Bad Hesselingen **has become an ambassador** who tells everybody that changing to AFM was their best decision. We take advantage of that.

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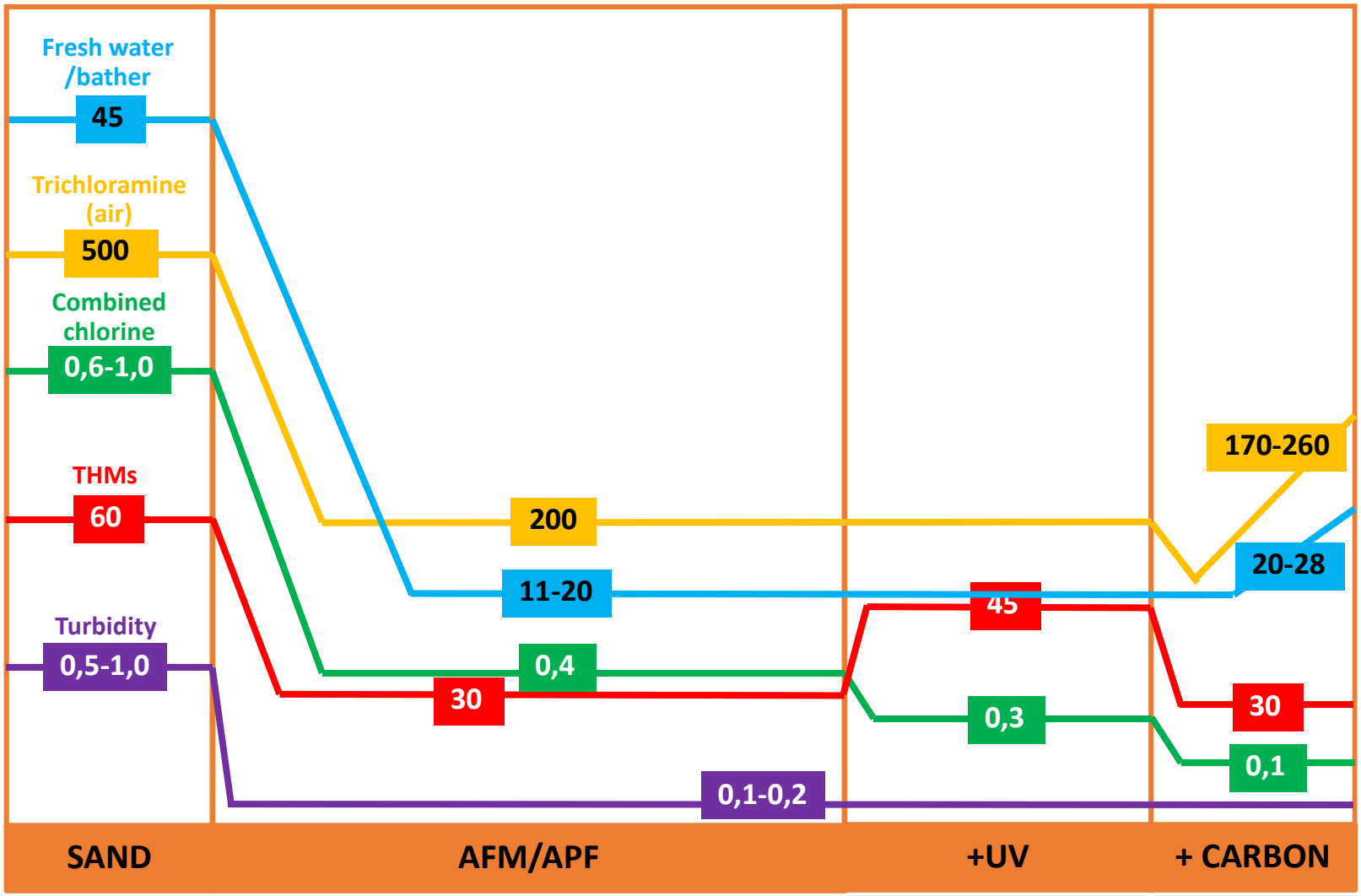
Results



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SUMMARY

- AFM/APF is working very well. Results are very steady. Better water with significant savings on water, chemicals, electricity.
- UV decreases combined chlorine a bit (0,1 mg/l), but THMs went up.
- Active Carbon decreased combined chlorine (0,2 mg/l) and THMs went down again
- Fact is that AFM/APF cause a huge difference. UVc or Active Carbon can be useful to lower combined chlorine at indoor pools.
- ZPM will improve results even more (not part of the test at Hesselingen).

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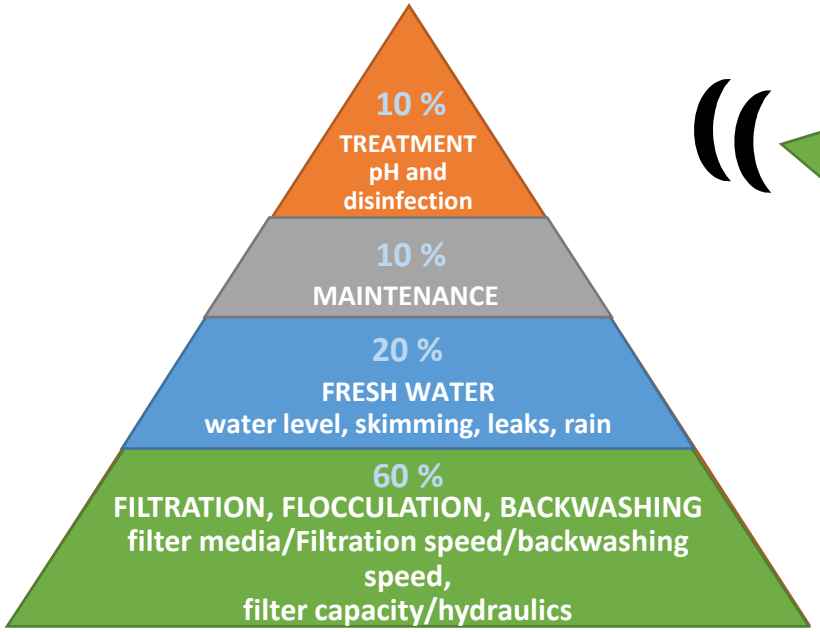
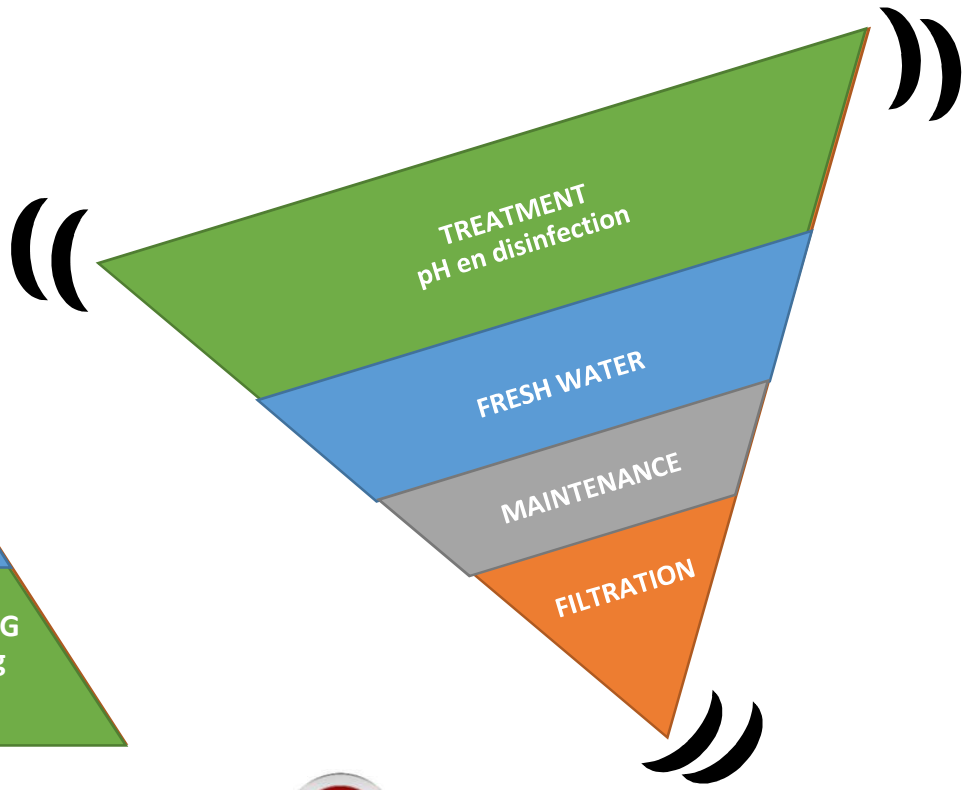
Pyramid of pool water treatment





GOOD!
Filtration FIRST

- **Better water quality, stable**
- **Savings on energy, water, chemicals, labour, investment**

WRONG!
Water treatment first

- **Poor water quality, unstable**
- **High consumption of energy, water, chemicals, labour, investment**

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